

# T.B.C. : 2024/JS/P-II

Serial No :

0144

ROLL NO.

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Time Allowed : 3 Hours]

[Maximum Marks : 120

## QUESTION PAPER SPECIFIC INSTRUCTIONS

Read each of the following instructions carefully before attempting questions.

1. There are **EIGHT** questions in **TWO** Parts in this paper.
2. The candidate has to attempt **(06) SIX** questions by choosing at least **(03) THREE** questions from each part.
3. All questions carry equal marks. Each question will consist of 4 sub-parts having 05 marks and word limit will be 150 words for each sub-part.
4. Write answers in legible handwriting. Illustrate your answers with suitable sketches, diagrams and figures, wherever considered necessary.
5. Each part of the question must be answered in sequence and in the same continuation.
6. Attempts of the questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in answer booklet must be clearly struck off.
7. Use of scientific (non-programmable) calculator is allowed.

**IMPORTANT NOTE : ANSWER ANY (03) THREE QUESTIONS FROM EACH PART.**

USE OF MOBILE PHONES OR ANY OTHER COMMUNICATION DEVICES IS STRICTLY PROHIBITED IN THE EXAMINATION



## PART-I

1. Answer the following :

4×5=20

- (a) Explain the principles of equilibrium and how they are applied to solve problems in mechanics. Provide examples with free body diagram.
- (b) What is the difference between laminar and turbulent flow ? Explain the conditions under which each type of flow occurs.
- (c) Discuss the fundamental concepts of Maxwell's equations and their implications in electromagnetic wave propagation.
- (d) Explain the formation of absorption bands in UV-visible spectroscopy and its usage in the characterization of chemical compounds.

2. Answer the following :

4×5=20

- (a) How are the remote sensing platforms classified ? Discuss various resolutions used in remote sensing.
- (b) Explain the steps to create a digital elevation model in a GIS environment. Write any *two* applications of DEM in Civil Engineering.
- (c) Describe the method of sections and the method of joints in analyzing truss structures.
- (d) Explain the difference between :
  - (i) Orthographic and Isometric projection
  - (ii) First-angle and Third-angle projection methods.



3. Answer the following :

4×5=20

- (a) What are the factors considered for site selection of a bridge ? What are the different types of foundations used in a bridge ?
- (b) What are the different types of brick bonds used in masonry ? Explain with suitable diagrams.
- (c) Two survey stations P and Q are situated at 2000 m horizontal distance. A theodolite was setup at P. The angle of depression to the top of a vane held vertically at Q was  $4^{\circ}12'$ . If the staff reading on a BM of elevation 280.855 m was 1.750 m, find out the elevation of Q. Take the height of vane as 2.5 m.
- (d) Explain the following :
  - (i) Solar passive building planning.
  - (ii) Raster and vector data structures in GIS.

4. Answer the following :

4×5=20

- (a) Find the eigenvalues and eigenvectors for the following matrix :

$$\begin{bmatrix} 5 & -10 & -5 \\ 2 & 14 & 2 \\ -4 & -8 & 6 \end{bmatrix}$$

- (b) Describe the process of finding maxima and minima of a function.
- (c) Define folds, faults and joints in Geology. Explain the seismic methods of geophysical investigations.



(d) Answer in one word :

- (i) Which type of culvert is used in high discharge areas and low debris flow areas ?
- (ii) Which bridge is composed of several small spans for crossing a valley ?
- (iii) Which bridge is constructed by two or more hanging cables in a curved shape and supporting the roadway ?
- (iv) IS codes prohibit the steel grade greater than ..... while considering the design of R.C. buildings for providing ductility.
- (v) Ratio of the volume of void to the total volume of a rock sample is called .....

## PART-II

5. Answer the following :

4×5=20

- (a) What is Limit State method ? State the steps for design of beam using Limit State method.
- (b) What are the factors which affect the life of reservoir ? Discuss the salient points of design of Weir and Barrage.
- (c) What are the water quality parameters ? Write their significance in domestic use.
- (d) What are the sources of air pollution ? Discuss the methods for assessment of impact of air pollution.



6. Answer the following :

4×5=20

- (a) Discuss Standard Penetration Test (SPT). What are the various corrections associated with it ?
- (b) Briefly explain :
  - (i) Disposal techniques of solid waste.
  - (ii) Difference between aqueduct and super passage.
- (c) What are the different types of spillways ? Why is spillway important in hydropower projects ?
- (d) Discuss different types of hydropower plants. What is the purpose of desilting basins ?

7. Answer the following :

4×5=20

- (a) Describe different type of aquifers on the basis of their properties. Discuss groundwater table fluctuations.
- (b) Discuss the significance of critical path in CPM. How does the identification of the critical path help in project scheduling and resource allocation ?
- (c) What are the factors associated with tunnel alignment ? Discuss the importance of ventilation in tunnels.
- (d) Discuss the objectives and methods of primary treatment in wastewater management, covering the design criteria and description of main unit operations.



8. Answer the following :

4×5=20

- (a) Discuss the key considerations in the geometric design of railways. How does this impact the overall safety of railway systems ?
- (b) Describe the different types of steel sections used in construction and their applications. Discuss the advantages and disadvantages of each type.
- (c) Explain the classification of roads and different road patterns commonly used in transportation planning.
- (d) Explain the step-by-step procedure for developing an Environmental Impact Assessment (EIA) for a proposed industrial project for the assessment of impact on soil, groundwater and socio-economic aspects.